UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Health and Safety
District C

Welch, West Virginia
February 12, 1959

Memorandum

To: Edward Thomas, Chief, Roof Control Research Group

From: J. L. Gilley, Mining Health and Safety Engineer

Through: W. R. Park

Subject: Report on investigation of miner coal outburst (bump), Mary Helen No. 3 mine, Mary Helen Coal Corporation, Coalgood, Harlan County, Kentucky

A coal outburst or bump in Mary Helen No. 3 mine, Mary Helen Coal Corporation, Coalgood, Harlan County, Kentucky, at 10:45 a.m., February 4, 1959, caused minor injuries to a cutting-machine operator and his helper. The four other employees on the section were not in the immediate vicinity of the affected pillar and were not injured. The cutting-machine operator's most serious injury was a painful bruise of the muscle at the front of the right thigh, and his helper received a small laceration and a few abrasions of the forehead. The two workmen were taken to a hsopital in Harlan, Kentucky, for treatment and observation and released three days later. Incidentally, these were the first lost-time injuries from a coal outburst at this mine since October 18, 1957.

The outburst occurred while the cutting-machine crew was undercutting an open-end lift (pocket) with an 11 RU Joy cutting machine (permissible type) in the first pillar block (the last remaining pillar) in No. 7 room on 9 left off 5 face south. (See Sketch No. 1). The pillar lift was the first lift to be turned into this block from the room side, and it was 16 to 18 feet in width and 20 feet in depth; however, from sketch No. 2 it will be noted that a similar open-end lift is projected a distance of 30 feet into the block (next to the gob) from the 9 left entry, but this pillar lift was abandoned after development of a bad roof condition and subsequent collapse of the roof at the entrance to the lift. This condition led to the decision to turn the alternate open-end lift from the No. 7 room side of the block and complete extraction of the block from this side. The pillar being worked was the only one affected by the outburst.

Copy to: James Westfield (2)
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The Mary Helen No. 3 mine is opened by several drifts and is operated in the high-volatile bituminous Harlan coal bed, which averages 42 inches on the property. The coal is glossy and black in color, extremely brittle and possesses a comparatively high degree of hardness. The coal breaks or shatters readily under stress or a blow. Pulverization of the coal by abnormal stress upon the pillars, produces a true dark brown color of bituminous coal. Generally, face and butt cleavage planes are distinct and well defined.

Development and pillar extraction was by a room-and-pillar method. Pillars were extracted by single open-end pillar lifts from either the room or the crosscut side of the blocks, but alternate lifts were not worked simultaneously in the same block. Main and cross entries were driven in sets of 3, and the room entries off 5 face south territory were driven in sets of two at intervals of 250 to 350 feet. Entries were 16 feet or more in width on 60-foot centers and rooms in the area were 20 feet or more in width on 70- to 100- foot centers. Crosscuts were 60 to 90 feet apart. Slabbing of pillars for passageways was frequent but to a lesser degree than in the past. The pillars presently being extracted in 9 left were developed in 1942-43, and many of them are of unequal dimensions; consequently, over the years, extensive roof falls and heaving of the mine floor have occurred in the openings surrounding several of the pillars. Mining conditions in 9 left, and in 10 left too, are tough and expensive.

The depth of the cover over the area extending from 7 left to 12 left off 5 face south ranges from about 1,500 to 1,800 feet. The irregular crests of the mountain range on the property have elevations in excess of 3,500 feet. The main roof in the area is predominately thick massive, fine-grained sandstone, reportedly ranging up to 60 feet in thickness. Several of the overlying stratum of sandstone, according to logs of boreholes, indicate thicknesses of 23 to 71 feet. Localized dispositional changes in structure of the immediate roof occur and in many instances very abruptly, such as in the immediate vicinity where the outburst occurred in the No. 7 room pillar. From inspection of the caved material in the mined-out area 25 feet inby the No. 7 room pillar, the immediate roof was thick sandstone, but the immediate roof overlying the pillar and extending to and beyond No. 1 room in 9 left was dark gray, irregularly laminated shale ranging up to 5 feet thick.

The floor for the first 2 to 10 feet generally was a hard dense shale that heaved extensively under the excessive pressures encountered; this formation is underlain by sandstone several feet thick. (In some areas as much as 60 feet thick.).

Methods of roof support in the 5 face south area, including 9 left, consisted of posts, three-piece timber sets, cribs and roof bolts, or combinations of these methods depending upon conditions.

It will be noted that from Sketch No. 1 that the 9 left pillars were in fair alignment with the corresponding pillars in the 8 left panel, not withstanding the fact that the 9 left section was about 2 months later getting started then 8 left, and 3 months later than 10 and 11 lefts. Because of the adverse conditions in 9 left, concerted effort was made to bring the 9 left line of extraction abreast as rapidly as feasible so as to maintain a relatively flat pillar line.

It is well to point out that the 9 left entry and air course and the first pillar in each of the rooms in 9 left, are situated at the lowest horizon of a rather steep local indulation or basin extending from 8 left to the center of 10 left. The crest of the grade in 8 left and in 10 left is about 15 and 25 feet higher, respectively, than the 9 left areas mentioned above.

At the time of the outburst, the third undercut was being made in No. 7 room pillar lift, as indicated in Sketch No. 2, and the loading machine was in the second pillar in No. 6 room, but was not operating. The cutting machine had cut about three-fourths across the face from the open-end toward the coal rib, and the cutting-machine crew were at the locations indicated in Sketch No. 2.

The reaction of the outburst forced the cutting machine sidewise (jack-knife fashion) about 3 feet and about 12 tons of coal was thrown from the coal rib but none was thrown from the face of the lift. Most of the coal it will be noted, was thrown outward from the corner of the pillar (at the entrance to the lift) and a cavity about 1-1/2 feet in diameter extended about 8 feet within the pillar. This cavity evidently was the result of the comparatively violent expulsion (outward movement) of the coal at the corner of the pillar lift. The roof in the immediate vicinity of the outburst was not shaken down or detached, but several cracks opened in the roof in the pillar lift involved and a lesser number were observed in the adjacent No. 6 room pillar. There were three crossbars in addition to posts set according to plan in the pillar lift. One crossbar was broken, one was dislodged, and a timber was knocked from under the end of the third crossbar by the outrush of coal and/or forces. Damage to the cutting machine consisted of a burst hydraulic hose, a bent boom-swing-jack piston rod, and a broken cutter-chain adjustment bolt. Reportedly, gas was not detected with a flame safety lamp and the electric power was cut off immediately after the outburst.

The cutting-machine operator and his melper, in addition to receiving the injuries previously mentioned, were stunned momentarily, but before workmen arrived from the adjacent No. 6 room pillar, the cutting-machine helper had made his way out of the pillar lift on to No. 7 room roadway. The cutting machine operator was assisted out of the place by other workmen. Both men were given first-aid treatment and taken to the surface, where they were examined by a doctor thence taken to a hospital.

A coal outburst or bump is a cumulative process which manifests itself in one or more ways, but unfortunately its manifestations are not always recognized in time. For one thing, the industry presently has no equipment available to indicate the increase in degree to which a pillar is liable to sudden outburst nor to give sufficient warning of an impending outburst. Therefore, where mining is done in the presence of natural conditions favorable for outbursts, every precaution needs to be taken to avoid, insofar as possible, critical areas through proper mining methods and practices.

Investigation and study of areas where natural conditions are favorable for outbursts at this mine has revealed that when attempt is made to extract the pillars that have been developed for a considerable length of time and are not reasonably equal in dimensions and in shape, outbursts of more or less violence are most likely to occur in some of them, regardless of which side of the pillar the lift is driven, if such lift is driven as much as 10 to 18 feet with machinery.

The pillars in the 5 face south area have been extracted as completely as practicable since 1957, and I might add, as completely as at any mine I have visited. Pillar lifts have been driven strictly open-ended and usually 16 to 20 feet in width. Development of room pillars has (since 1957) been limited to 2 blocks outby the line of extraction so as to slow the abutement movement and minimize heaving of the floor. Use of cribs was introduced to better control the roof and "inducer" blasting of pillars has been used.

Knowledge of some of the factors which contributed to this outburst was obtained by study of conditions during previous visits to this mine. These factors include: (1) Presence of natural conditions (1,600 to 1,800 feet of cover, massive sandstone roof near the coal, hard dense mine floor, a strong but brittle coal). (2) Poor planning insofar as the minimization of coal outbursts is concerned, in that the 9 left panel (and other room panels) was developed several years in advance for no apparent reason other than expediency. This lack of forethought has made second mining very hazardous and expensive. (3) Many of the pillars were not reasonably uniform in size nor shape. (See Sketch No. 1). Other factors include: (1) Evidence that the main massive sandstone roof was on the "move" not only in the mined-out area of 9 left, but also in the mined-out areas of 8 and 10 lefts flanking 9 left, thus probably superimposing additional stress upon the 9 left pillars. Furthermore, the pillar where the outburst occurred was (and some of the other pillars in 9 left are) situated at the lowest horizon of a local syncline or basin extending from 8 left to 10 left. (2) A local dispositional change occurred in the structure of the roof from a massive sandstone to 5 feet of irregularly bedded shale. (3) Cribs, as suggested, were not used to support the roof and serve as a "breaker line" prior to turning the open-end lift into the No. 7 room pillar from the entry side. (4) Inducer shots (blasting) as recommended, were not used in the rib and face of the pillar lift during advancement and in the pillar at the location of and prior to turning the pillar lift.

Recommendations, which are thought will minimize coal-outbursts, have often been discussed with the management at this mine, and subject meetings which included the workmen, have been held. It is thought that considerable good has been accomplished, but the problem is ever present and is dealt with daily at this mine. The recommendations made during this investigation include:

1. The system of mining should be designed to produce the least number of critical areas during second or retreat mining. (Future development is now planned accordingly.)

2. The coal pillars should be, insofar as practicable, uniform in size and in shape.

3. Sufficient cribs, in conjunction with other roof supports, should be used to support the roof and keep the roadways or passageways to the pillar workings open and in safe condition. (It is believed that if the first pillar lift from the entry side had been completed, the outburst likely would not have occurred.)

4. Inducer shooting should be used in the extraction of stressed pillars regardless of whether the coal is cut with a mining machine or is blasted (in accordance with State permit) from the solid. Foremen should supervise this type of work.

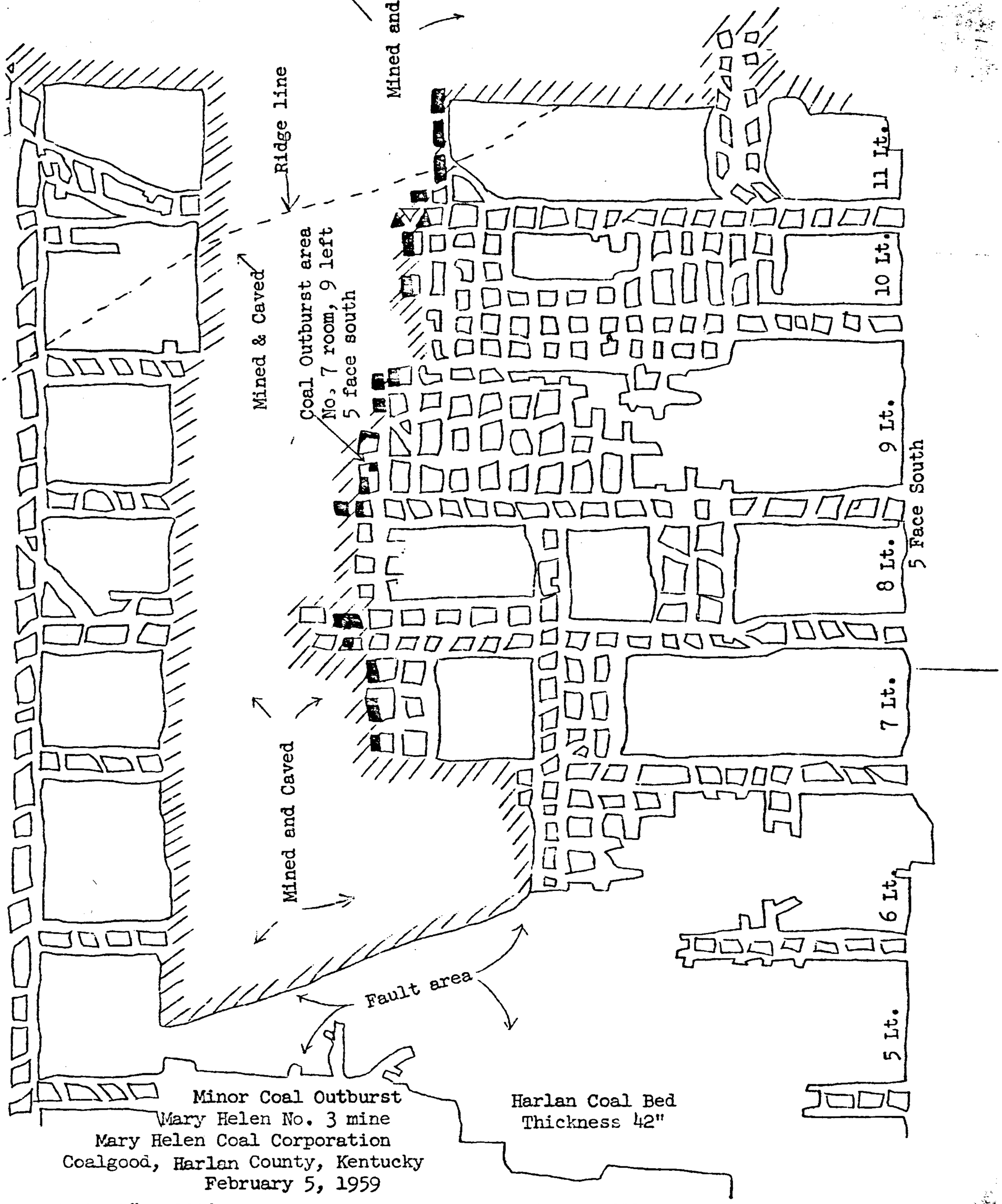
5. Concerted effort should be continued in extraction of pillars in proper sequence so as to minimize over-stressing of individual pillars.

Frequent visits by the author, often accompanied by a Federal and/or State inspector, have been made to this mine to observe conditions and progress in mining certain areas. Needless to say the coal outburst potential is ever present in some areas and often in pillars less than 20 feet thick in this mine, and every precaution in mining such areas is necessary.

/s/ J. L. Gilley

J. L. Gilley

Sketch No. 1

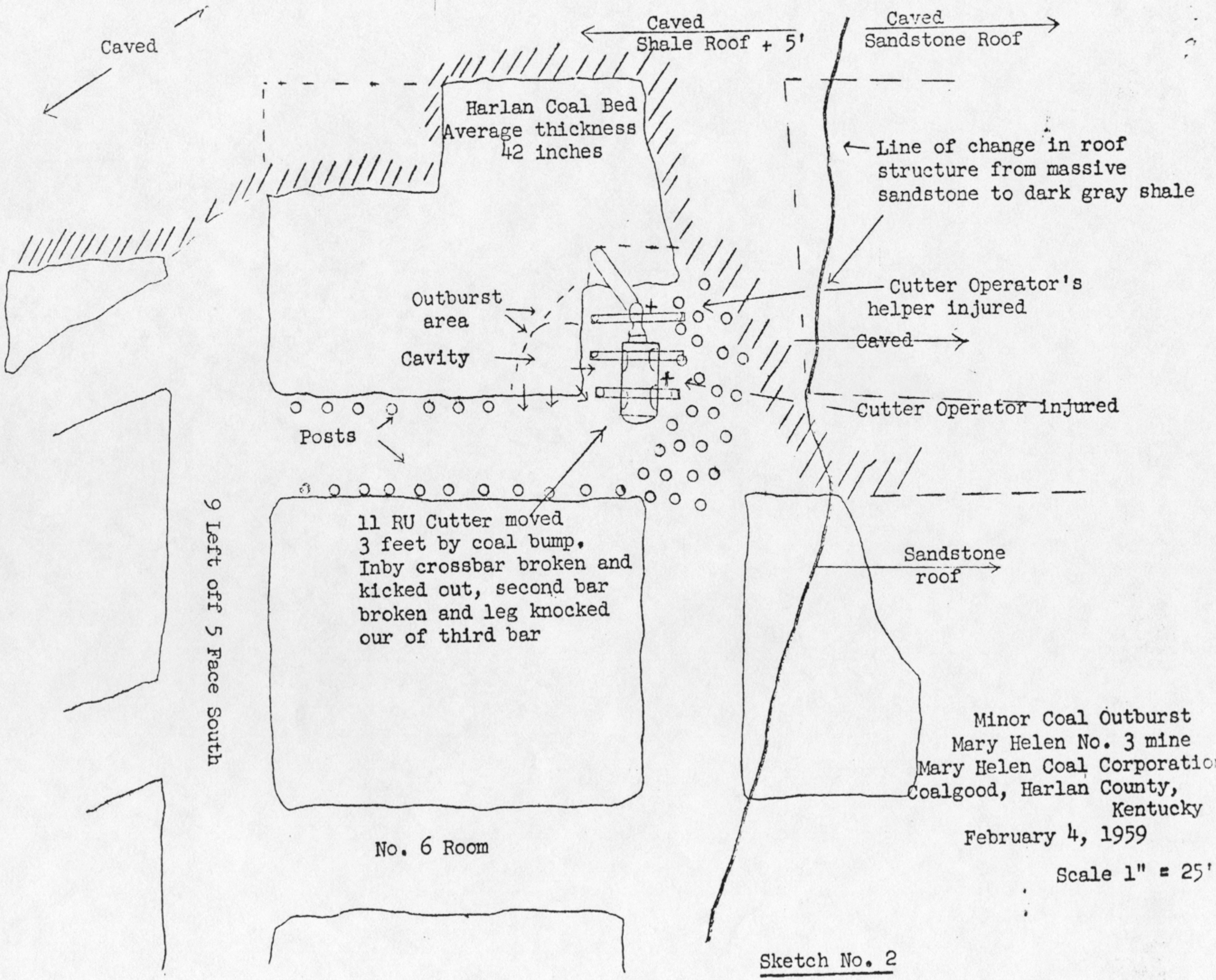


Minor Coal Outburst
Mary Helen No. 3 mine
Mary Helen Coal Corporation
Coalgood, Harlan County, Kentucky
February 5, 1959

Harlan Coal Bed
Thickness 42"

Scale 1" = 300'

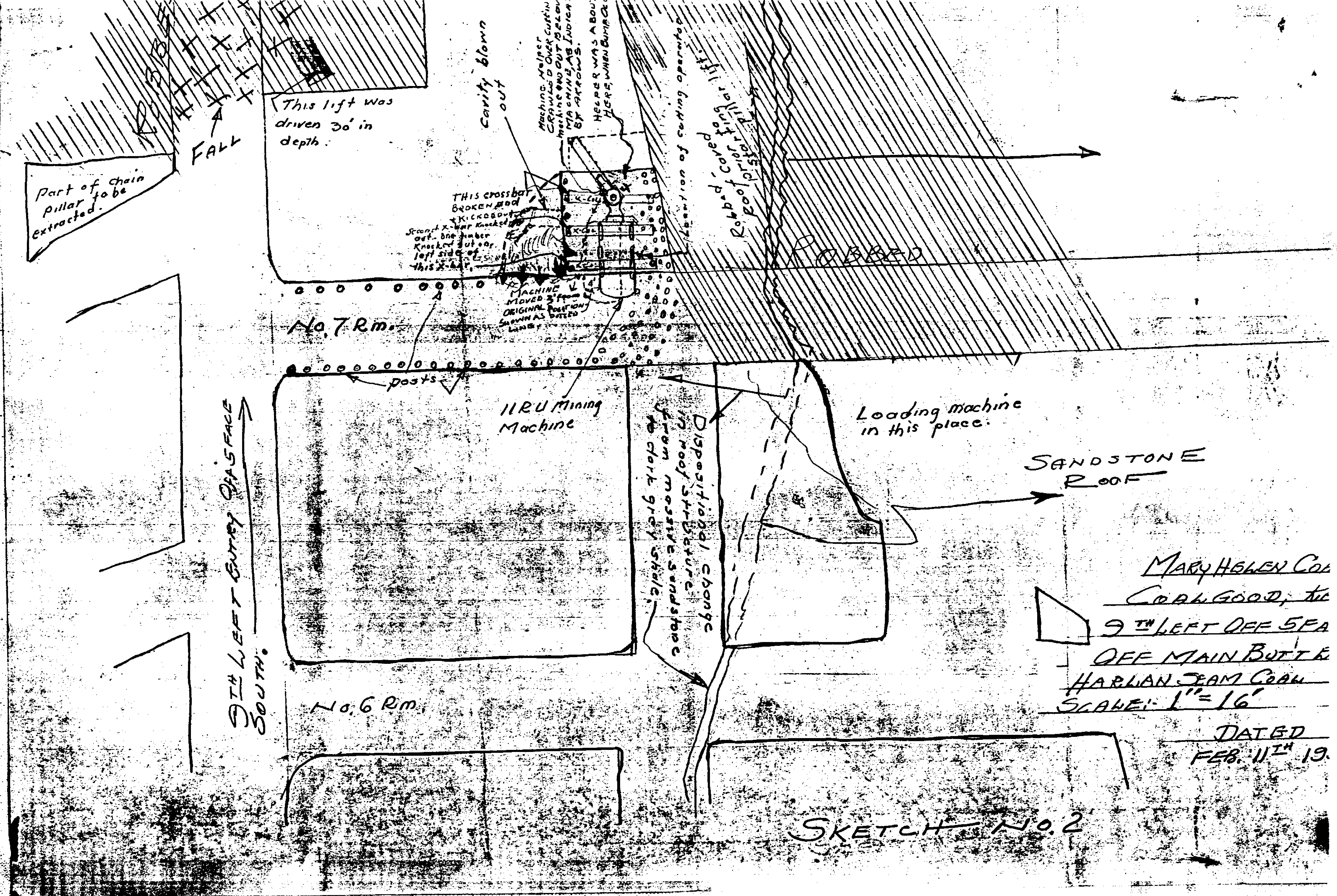
J. L. Gilley



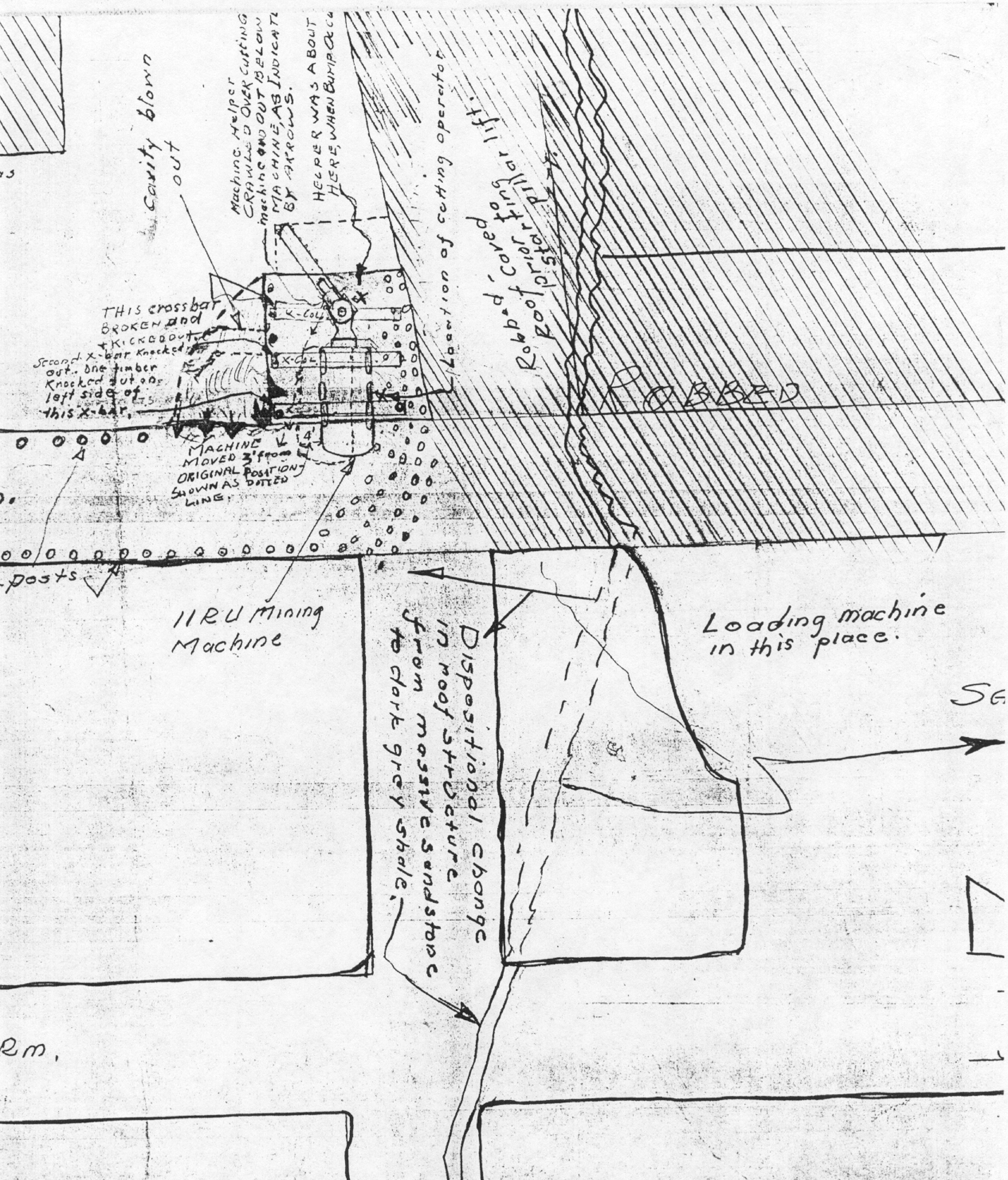
Minor Coal Outburst
Mary Helen No. 3 mine
Mary Helen Coal Corporation
Coalgood, Harlan County,
Kentucky
February 4, 1959

Scale 1" = 25'

Sketch No. 2



Part of chain pillar to be extracted.
FALL
This lift was driven 30' in depth.
Cavity blown out
Machine Helper CRAWLED OVER CUTTING machine and OUT BELOW MACHINE AS INDICATED BY ARROWS.
HELPER WAS ABOUT HERE WHEN BUMP OCCURRED
Location of cutting operator
Robbed - Roof Caved prior to starting pillar lift.
ROBBED
THIS crossbar BROKEN and KICKED OUT
Second X-bar Knocked out. One timber Knocked out on left side of this X-bar.
MACHINE MOVED 3' from ORIGINAL POSITION SHOWN AS DOTTED LINES
No. 7 Rm.
posts
11RU Mining Machine
Dispositional change in roof structure from massive sandstone to dark grey shale.
Loading machine in this place.
SANDSTONE ROOF
9TH LEFT ENTRY OFF 5 FACE SOUTH.
No. 6 Rm.
MARY HELEN COAL
COALGOOD, KY
9TH LEFT OFF 5 FACE
OFF MAIN BUTT E
HARLAN SEAM COAL
SCALE: 1" = 16'
DATED
FEB. 11TH 19
SKETCH NO. 2


Cavity blown out
Machine Helper CRAWLED OVER cutting machine and OUT BELOW MACHINE, AS INDICAT BY ARROWS.
HELPER WAS ABOUT HERE, WHEN BUMP OCCU
Location of cutting operator
Robbed, cored roof prior to starting pillar lift.
THIS crossbar BROKEN and KICKED OUT.
Second X-bar Knocked out.. One timber Knocked out on left side of this X-bar.
X-Col
X-Col
4'
MACHINE MOVED 3' from ORIGINAL POSITION SHOWN AS DOTTED LINE.
ROBBED
posts
11RU Mining Machine
Dispositional change in roof structure from massive sandstone to dark grey shale.
Loading machine in this place.
Se
rm.

SKETCH NO.

Dark gray Shale roof 5'+

SHALE ROOF CAVED

ROBBED

CAVED

SANDSTONE ROOF

This lift was driven 30' in depth.

Cavity blown out

Machine moved over cutting crawled out below machine as indicated by arrows.

Helper was about here when bumper cut.

THIS crossbar BROKEN and KICKED out

Second X-bar knocked out. One timber knocked out on left side of this X-bar.

K-Log

Machine moved 3' from original position shown as dotted line.

No. 7 Rm.

posts

11 R.U Mining Machine

Disposition changed in roof structure from massive sandstone to dark grey shale.

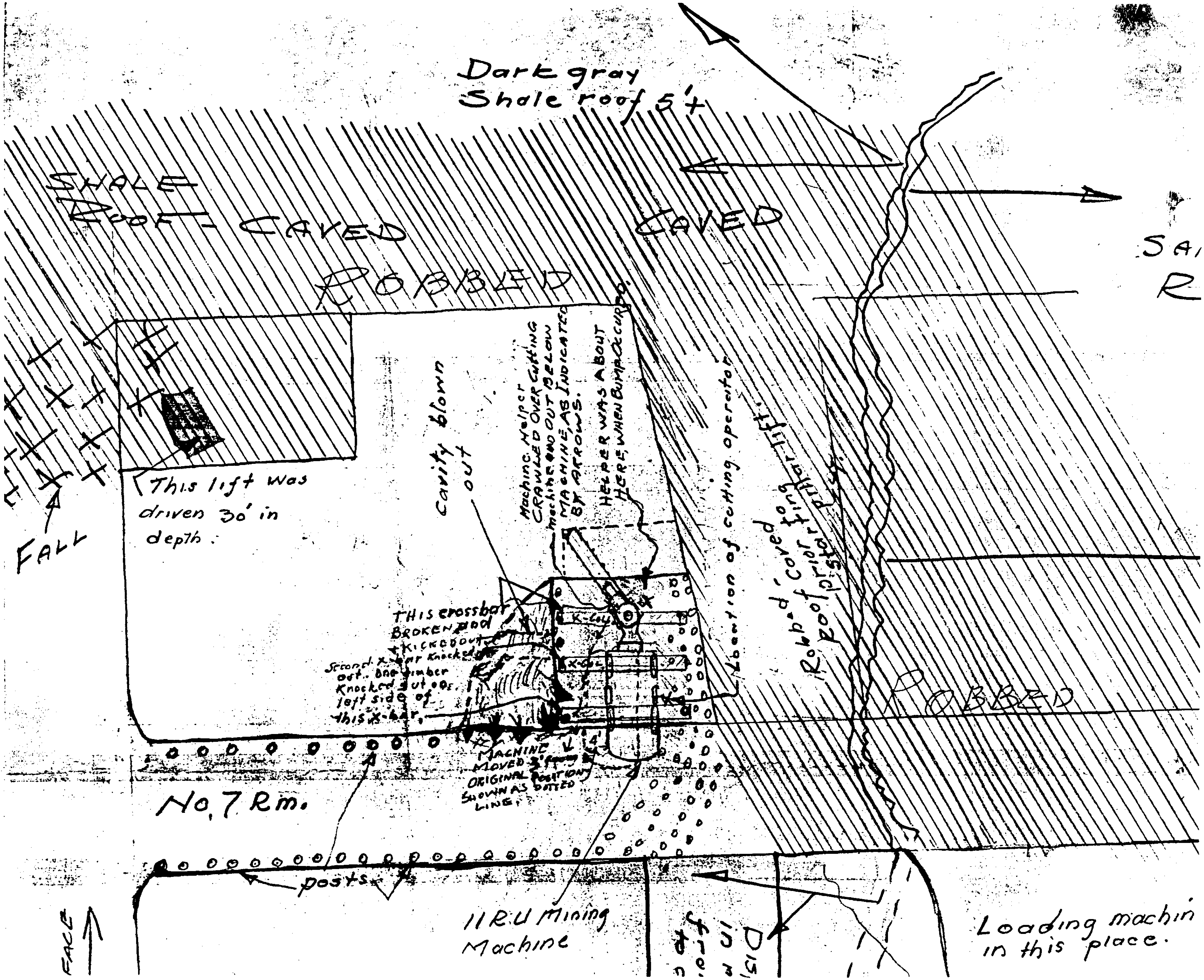
Loading machine in this place.

SANDSTONE ROOF

9TH LEFT OFF FACE SOUTH

MARY HELEN COAL CORP.

COBB, GOOD, KENTUCKY - No 7 RM. P.


Dark gray
Shale roof 5'±
SHALE
ROOF - CAVED
CAVED
ROBBED
This lift was
driven 30' in
depth.
FALL
Cavity blown
out
Machine Helper
CRAWLED OVER CUTTING
machine and OUT BELOW
MACHINE, AS INDICATED
BY ARROWS.
HELPER WAS ABOUT
HERE WHEN BUMP OCCURRED.
Location of cutting operator
Robbed - Roof caved
prior to
starting pillar lift.
THIS crossbar
BROKEN and
KICKED OUT
Second X-bar Knocked
out. One timber
Knocked out on
left side of
this X-bar.
K-Col
X-Col
MACHINE
MOVED 3' from
ORIGINAL POSITION
SHOWN AS DOTTED
LINE.
No. 7 Rm.
posts
11RU Mining
Machine
FACE
Loading machin
in this place.

MINOR COAL OUTBURST
MARY HELEN NO. 3 MINE
MARY HELEN COAL CORP.
COALGOOD, KENTUCKY
FEBRUARY 4, 1952

SCENE OF OUTBURST No. 7 Room 9 Left 5 Face South

5 FACE SOUTH

FAULT

Sketch No. 1

1" = 200'

MINOR COAL OUTBURST
MARY HELEN No. 3 MIN
MARY HELEN COAL CORP.
COALGOOD, KENTUCKY
FEBRUARY 4, 1959

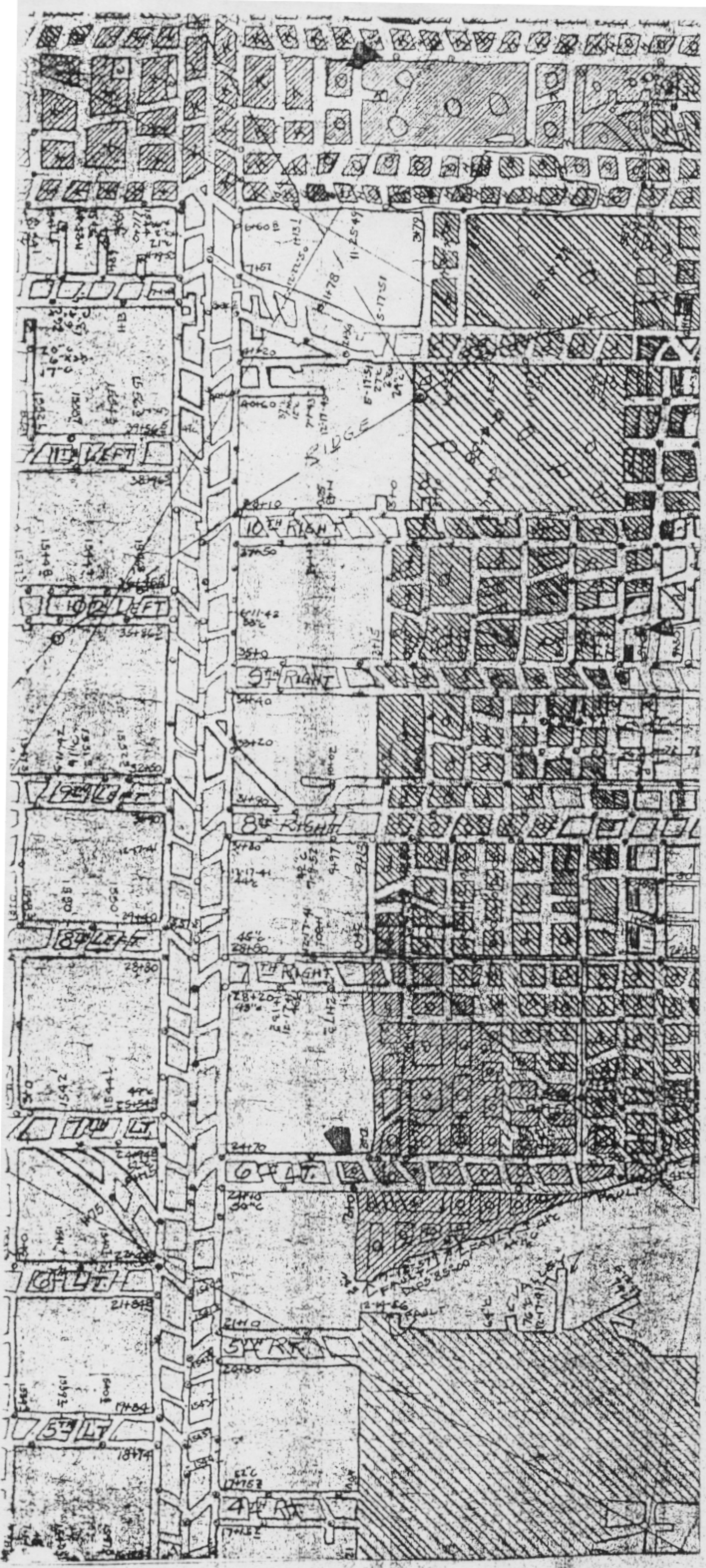
SCENE OF OUTBURST
No. 7 ROOM
9 LEFT 5 FACE
SOUTH

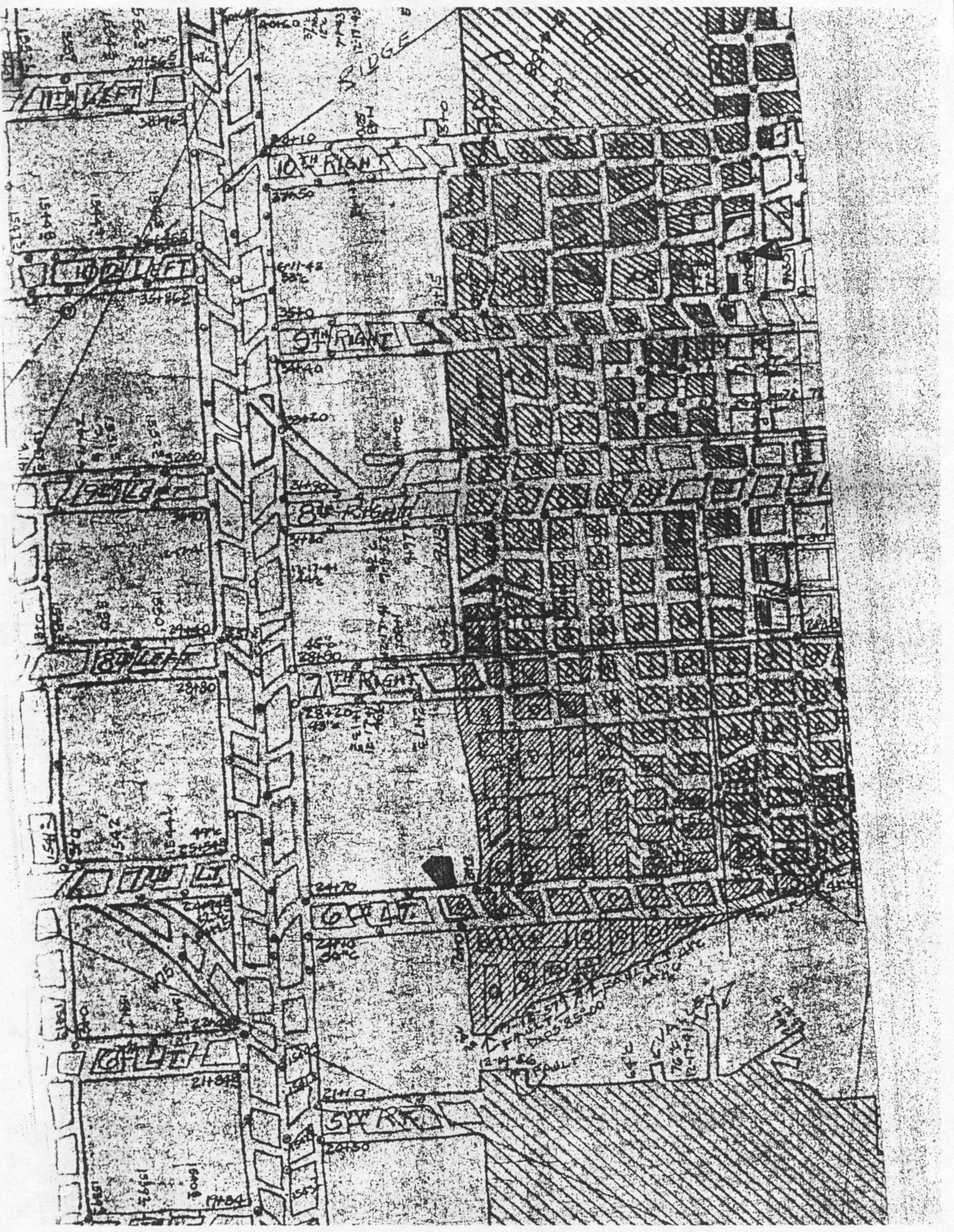
5 FACE SOUTH

FAULT

Sketch No. 1

1" = 200'


10TH RIGHT
9TH RIGHT
8TH RIGHT
7TH RIGHT
6TH LT.
5TH RT.
4TH RT.
10TH LEFT
9TH LEFT
8TH LEFT
7TH LT.
6TH LT.
5TH LT.
BRIDGE
FAULT


11TH LEFT
10TH RIGHT
10TH LEFT
9TH RIGHT
8TH RIGHT
8TH LEFT
7TH RIGHT
6TH LEFT
5TH RT
FAULT